

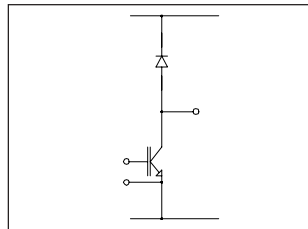
50MT060ULS

"LOW SIDE CHOPPER" IGBT MTP

Ultrafast Speed IGBT

Features

- Gen. 4 Ultrafast Speed IGBT Technology
- HEXFRED™ Diode with UltraSoft Reverse Recovery
- Very Low Conduction and Switching Losses
- Optional SMT Thermistor (NTC)
- Aluminum Nitride DBC
- Very Low Stray Inductance Design for High Speed Operation
- UL approved (file E78996)



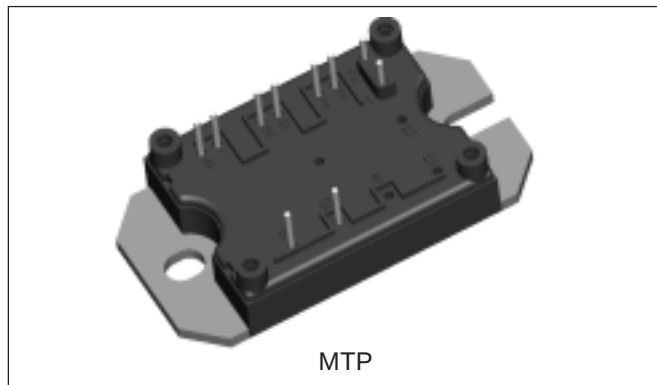
$$V_{CES} = 600V$$

$$I_C = 100A,$$

$$T_C = 25^{\circ}C$$

Benefits

- Optimized for Welding, UPS and SMPS Applications
- Operating Frequencies > 20 kHz Hard Switching, >200 kHz Resonant Mode
- Low EMI, requires Less Snubbing
- Direct Mounting to Heatsink
- PCB Solderable Terminals
- Very Low Junction-to-Case Thermal Resistance



MTP

Absolute Maximum Ratings

Parameters				Max	Units
V_{CES}	Collector-to-Emitter Voltage			600	V
I_C	Continuous Collector Current	@ $T_C = 25^{\circ}C$		100	A
		@ $T_C = 122^{\circ}C$		50	
I_{CM}	Pulsed Collector Current			200	
I_{LM}	Peak Switching Current			200	V
I_F	Diode Continuous Forward Current			48	
I_{FM}	Peak Diode Forward Current			200	
V_{GE}	Gate-to-Emitter Voltage			± 20	W
V_{ISOL}	RMS Isolation Voltage, Any Terminal to Case, t = 1 min			2500	
P_D	Maximum Power Dissipation	IGBT	@ $T_C = 25^{\circ}C$	445	
			@ $T_C = 100^{\circ}C$	175	
		Diode	@ $T_C = 25^{\circ}C$	205	
			@ $T_C = 100^{\circ}C$	83	

Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

Parameters	Min	Typ	Max	Units	Test Conditions
$V_{(BR)CES}$ Collector-to-Emitter Breakdown Voltage	600			V	$V_{GE} = 0V, I_C = 250\mu A$
$V_{CE(on)}$ Collector-to-Emitter Voltage		1.69	2.31		$V_{GE} = 15V, I_C = 50A$
		1.96	2.55		$V_{GE} = 15V, I_C = 100A$
		1.88	2.24		$V_{GE} = 15V, I_C = 100A, T_J = 150^\circ\text{C}$
$V_{GE(th)}$ Gate Threshold Voltage	3		6		$I_C = 0.5mA$
B_{VR} Diode Reverse Breakdown Voltage	600				$I_R = 200\mu A$
$\Delta V_{GE(th)}/\Delta T_J$ Temperature Coeff. of Threshold Voltage		- 13		mV/ $^\circ\text{C}$	$V_{CE} = V_{GE}, I_C = 500\mu A$
g_{fe} Forward Transconductance	22	29		S	$V_{CE} = 50V, I_C = 100A$
I_{CES} Collector-to-Emitter Leaking Current			0.25	mA	$V_{GE} = 0V, V_{CE} = 600V$
			6		$V_{GE} = 0V, V_{CE} = 600V, T_J = 150^\circ\text{C}$
V_{FM} Diode Forward Voltage Drop		1.64	1.82	V	$I_F = 100A, V_{GE} = 0V$
		1.56	1.74		$I_F = 100A, V_{GE} = 0V, T_J = 150^\circ\text{C}$
I_{GES} Gate-to-Emitter Leakage Current			± 250	nA	$V_{GE} = \pm 20V$

Switching Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

Parameters	Min	Typ	Max	Units	Test Conditions
Q_g Total Gate Charge (turn-on)		370	555	nC	$I_C = 100A$ $V_{CC} = 480V$ $V_{GE} = 15V$
Q_{ge} Gate-Emitter Charge (turn-on)		64	96		
Q_{gc} Gate-Collector Charge (turn-on)		163	245		
E_{on} Turn-On Switching Loss		0.7	1.2	mJ	$I_C = 50A, V_{CC} = 480V, V_{GE} = 15V,$ $R_g = 5\Omega$ Energy losses include tail and diode reverse recovery
E_{off} Turn-Off Switching Loss		1.7	2.6		
E_{ts} Total Switching Loss		2.4	3.8		
E_{on} Turn-On Switching Loss		1.1	1.7	mJ	$I_C = 50A, V_{CC} = 480V, V_{GE} = 15V$ $R_g = 5\Omega, T_J = 125^\circ\text{C}$ Energy losses include tail and diode reverse recovery
E_{off} Turn-Off Switching Loss		2.5	3.8		
E_{ts} Total Switching Loss		3.6	5.5		
C_{ies} Input Capacitance		9800	14700		$V_{GE} = 0V$ $V_{CC} = 30V$ $f = 1.0\text{ MHz}$ $V_r = 600V, f = 1.0\text{ MHz}$
C_{oes} Output Capacitance		602	903	pF	
C_{res} Reverse Transfer Capacitance		121	182		
C_t Diode Junction Capacitance		118	177		
t_{rr} Diode Reverse Recovery Time		99	150	ns	$V_{CC} = 480V, I_C = 50A$ $di/dt = 200A/\mu s$ $R_g = 5\Omega$
I_{rr} Diode Peak Reverse Current		6.5	9.8	A	
Q_{rr} Diode Recovery Charge		320	735	nC	
$di_{(rec)}/dt$ Diode PeakRate of Fall of Recovery During t_b		236		A/ μs	

Thermistor Specifications (50MT060ULST only)

Parameters	Min	Typ	Max	Units	Test Conditions
$R_0^{(1)}$ Resistance		30		k Ω	$T_0 = 25^\circ\text{C}$
$\beta^{(1)(2)}$ Sensitivity index of the thermistor material		4000		K	$T_0 = 25^\circ\text{C}$ $T_1 = 85^\circ\text{C}$

(1) T_0, T_1 are thermistor's temperatures

$$(2) \frac{R_0}{R_1} = \exp \left[\beta \left(\frac{1}{T_0} - \frac{1}{T_1} \right) \right], \text{ Temperatures in kelvin}$$

Thermal- Mechanical Specifications

Parameters	Min	Typ	Max	Units
T_J Operating Junction Temperature Range	- 40		150	$^\circ\text{C}$
T_{STG} Storage Temperature Range	- 40		125	
R_{thJC} Junction-to-Case	IGBT	0.18	0.28	$^\circ\text{C}/\text{W}$
	Diode	0.4	0.6	
R_{thCS} Case-to-Sink (Heatsink Compound Thermal Conductivity = 1 W/mK)	Module	0.06		
T Mounting torque to heatsink (3)		$3 \pm 10\%$		Nm
Wt Weight		66		g

(3) A mounting compound is recommended and the torque should be checked after 3 hours to allow for the spread of the compound. Lubricated threads

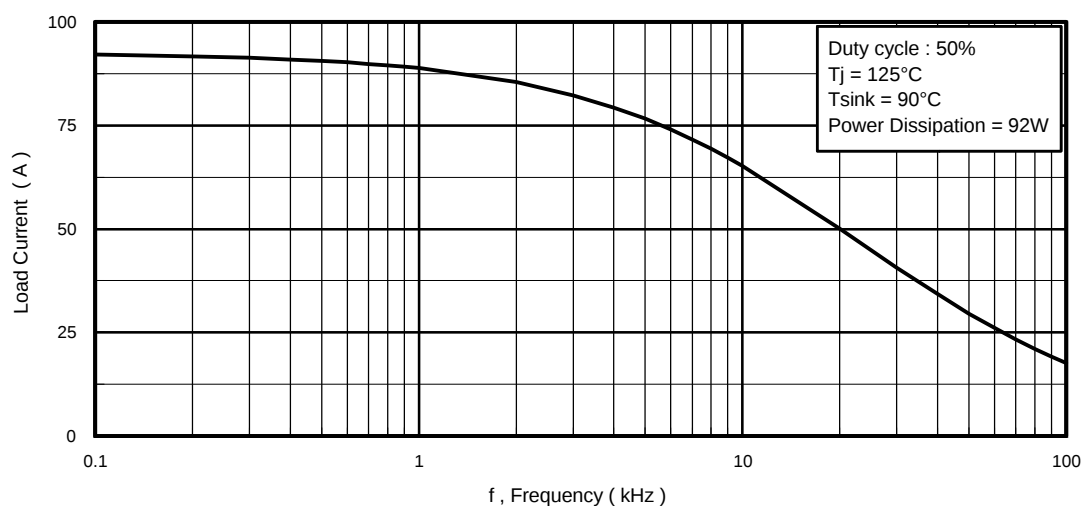


Fig. 1 - Typical Load Current vs. Frequency
(Load Current = I_{RMS} of fundamental)

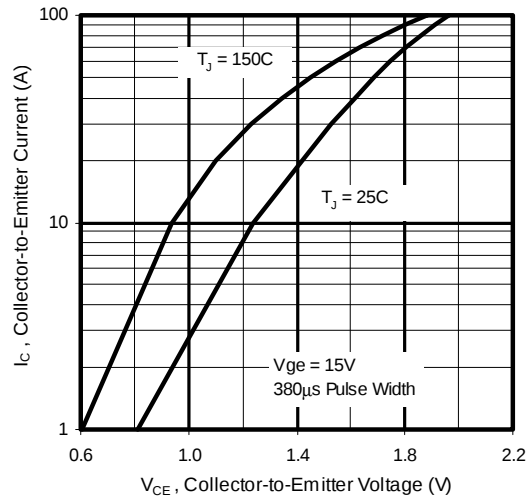


Fig. 2 - Typical Output Characteristics

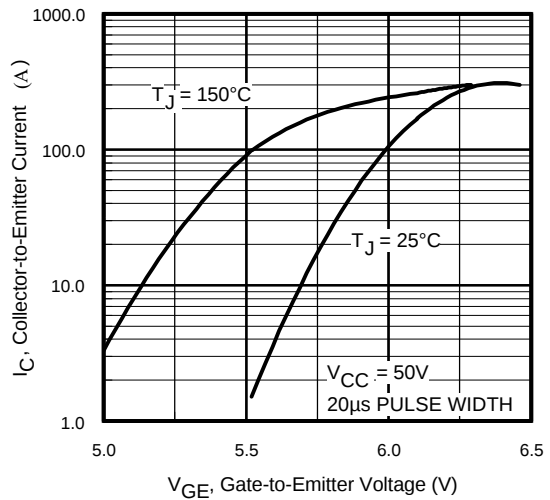


Fig. 3 - Typical Transfer Characteristics

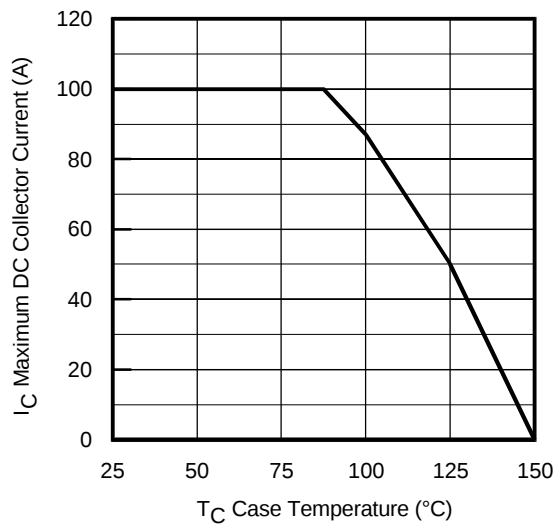


Fig. 4 - Maximum Collector Current vs. Case Temperature

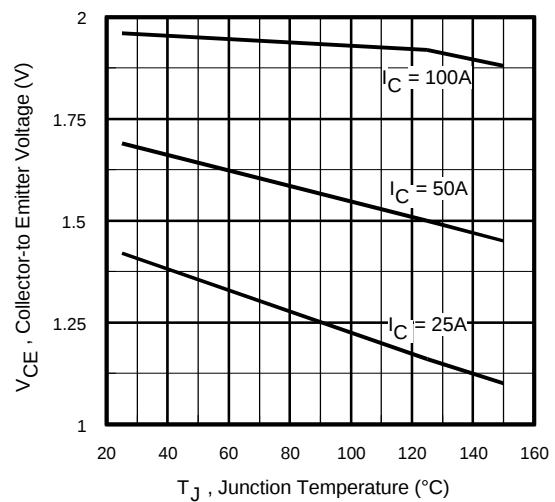


Fig. 5 - Typical Collector-to-Emitter Voltage vs. Junction Temperature

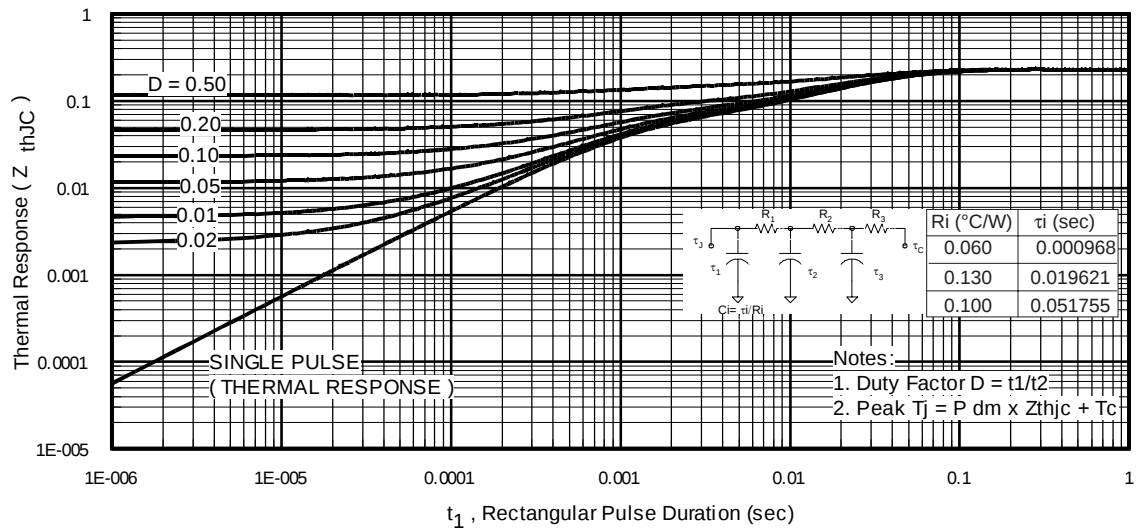


Fig. 6a Maximum Transient Thermal Impedance, Junction-to-Case (IGBT)

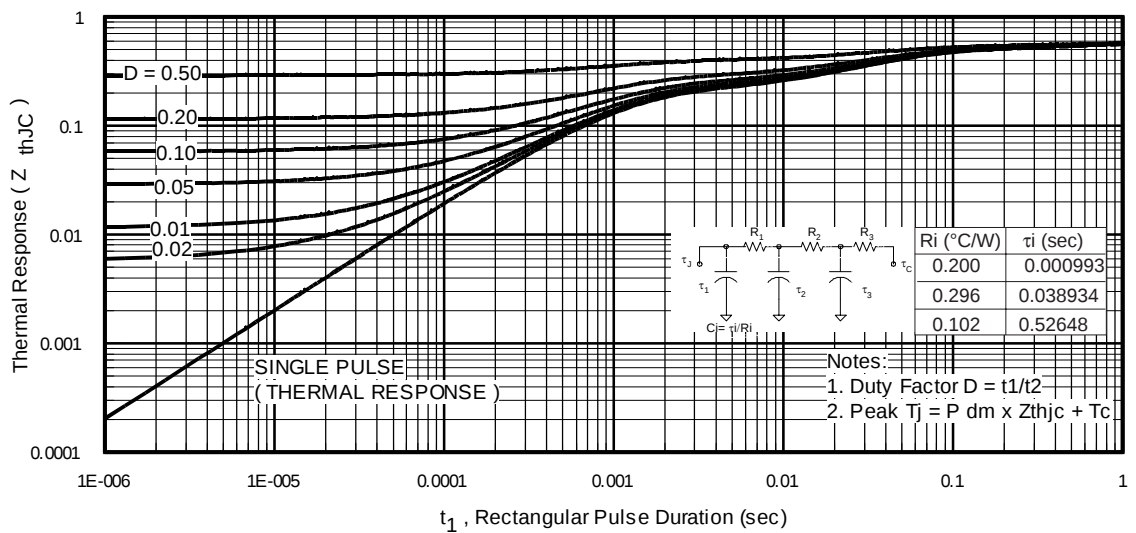


Fig. 6b Maximum Transient Thermal Impedance, Junction-to-Case (DIODE)

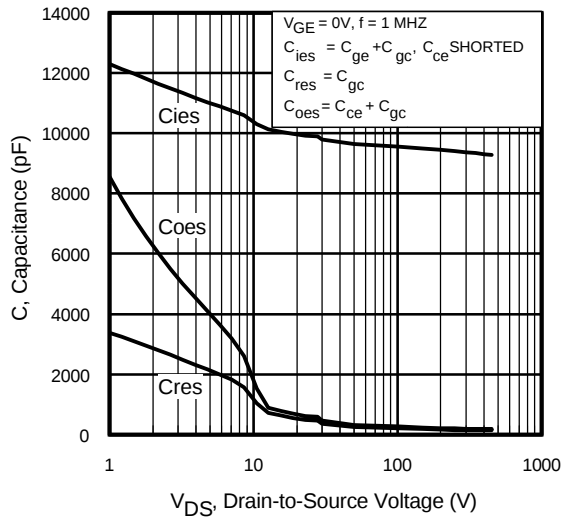


Fig. 7 - Typical Capacitance vs. Collector-to-Emitter Voltage

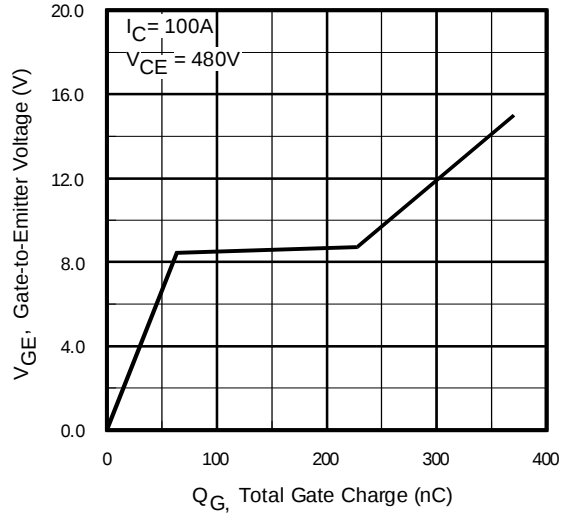


Fig. 8 - Typical Gate Charge vs. Gate-to-Emitter Voltage

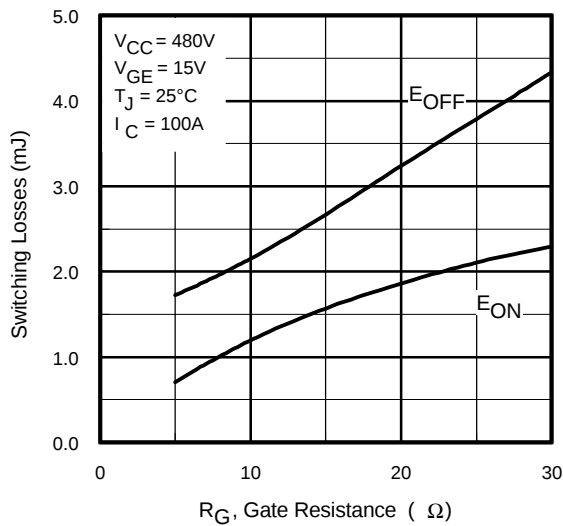


Fig. 9 - Typical Switching Losses vs. Gate Resistance

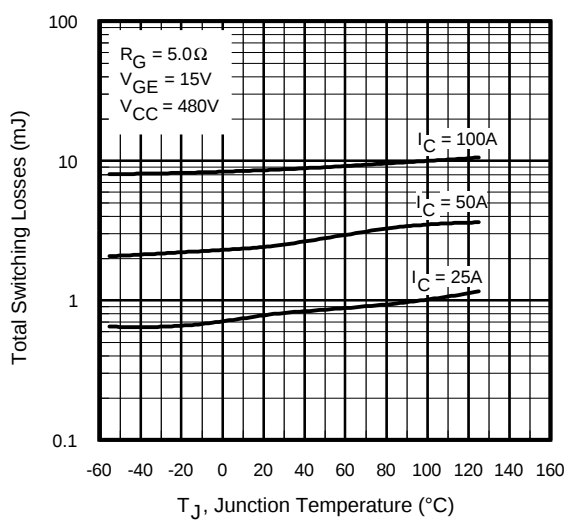


Fig. 10 - Typical Switching Losses vs. Junction Temperature

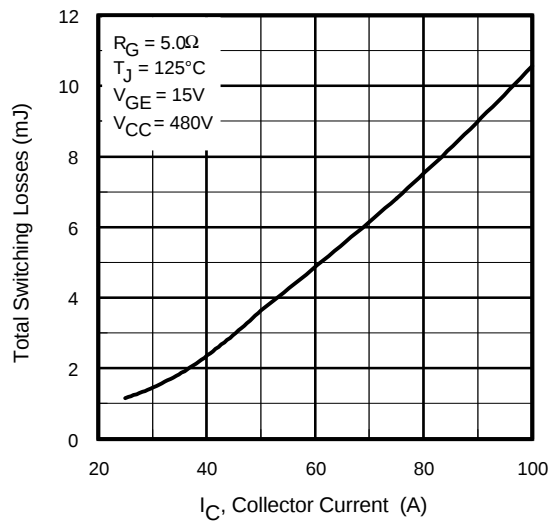


Fig. 11 - Typical Switching Losses vs.
Collector-to-Emitter Current

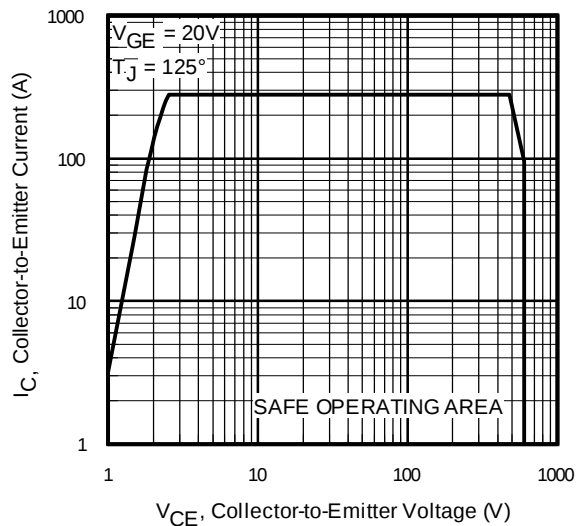


Fig. 12 - Turn-Off SOA

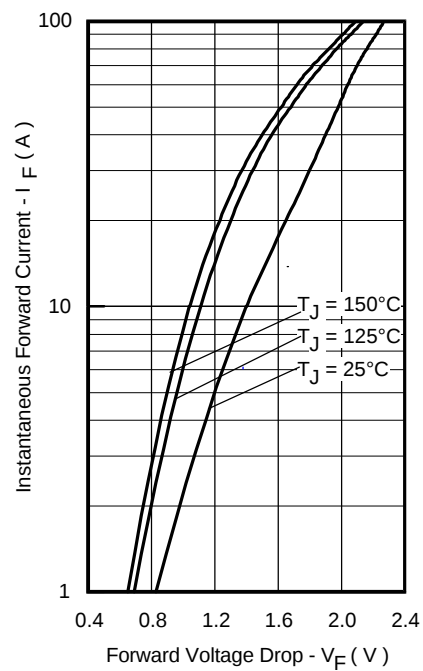


Fig. 13 - Maximum Forward Voltage Drop vs.
Instantaneous Forward Current

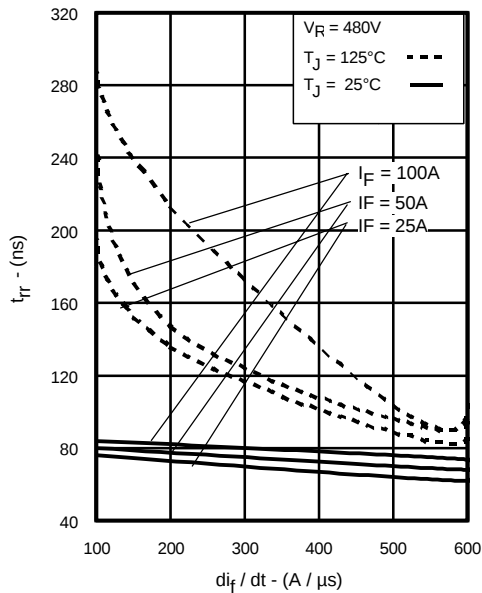


Fig. 14 - Typical Reverse Recovery vs. di_f/dt

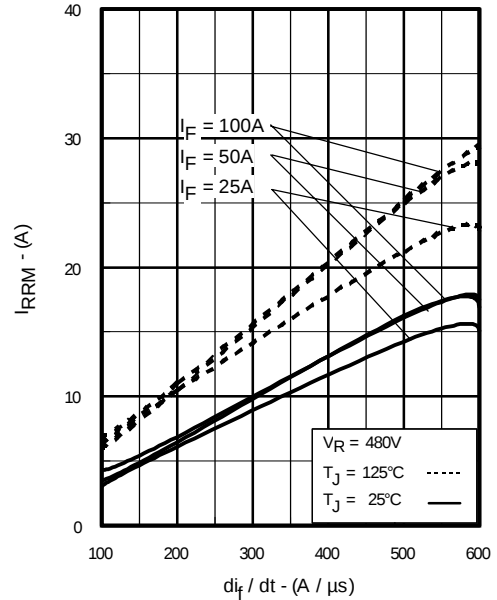


Fig. 15 - Typical Recovery Current vs. di_f/dt

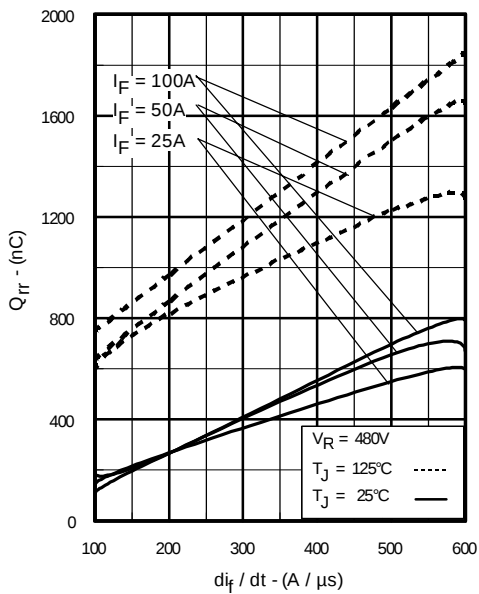


Fig. 16 - Typical Stored Charge vs. di_f/dt

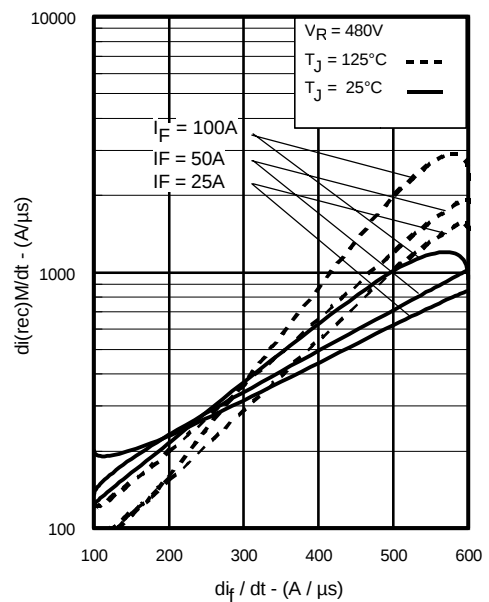
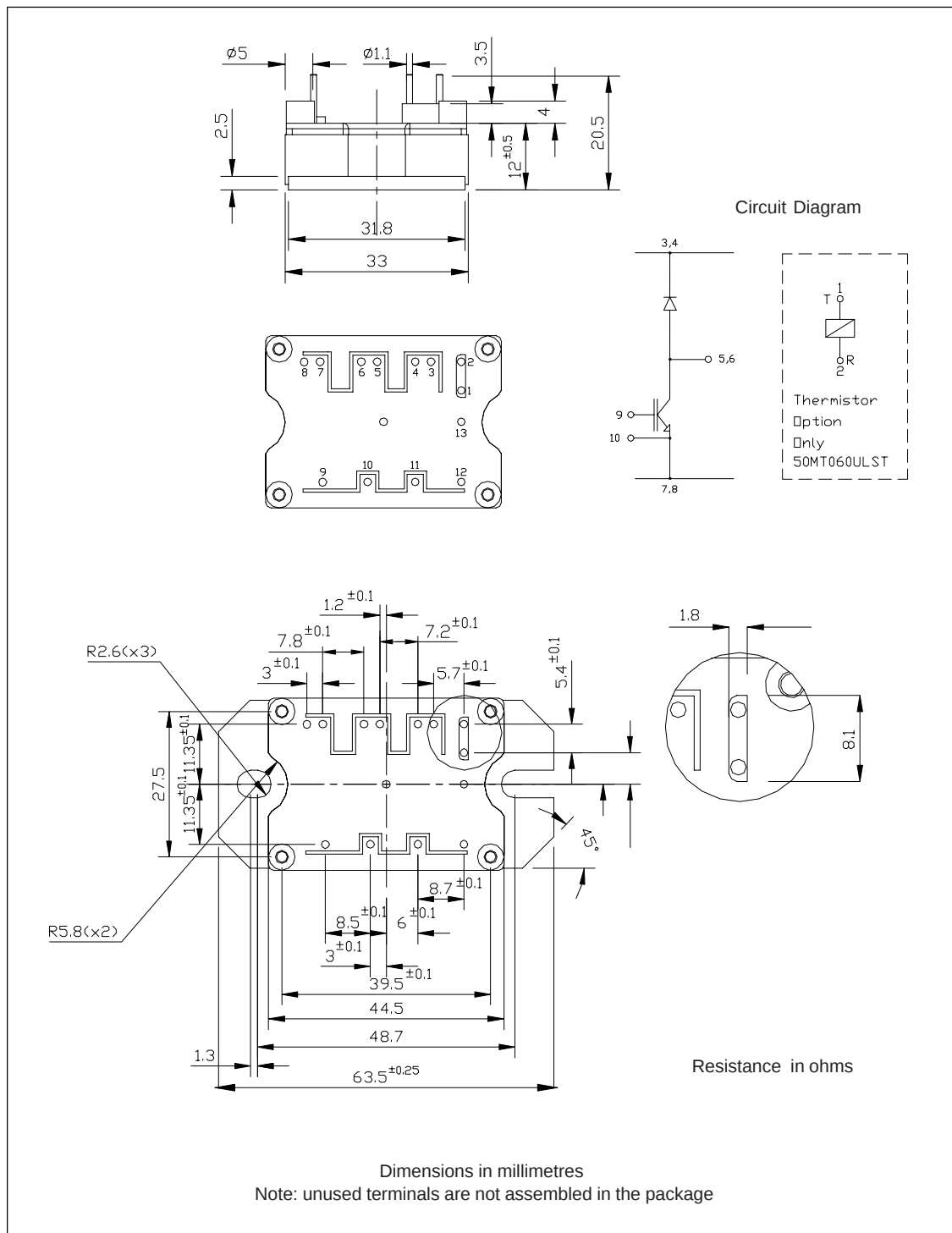


Fig. 17 - Typical $di_{(rec)M}/dt$ vs. di_f/dt

Outline Table



Ordering Information Table

Device Code					
	50	MT	060	U	LS -
	1	2	3	4	5 6
1	-	Current rating	(50 = 50A)		
2	-	Essential Part Number			
3	-	Voltage code	(060 = 600V)		
4	-	Speed/ Type	(U = Ultra Fast IGBT)		
5	-	Circuit Configuration	(LS = Low Side Chopper)		
6	-	Special Option			Empty = no special option T = Thermistor

Data and specifications subject to change without notice.
This product has been designed and qualified for Industrial Level.
Qualification Standards can be found on IR's Web site.

International
IR Rectifier

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